

Zerconid mites (Acari: Mesostigmata: Zerconidae) from Crete, Greece, with description of two new species

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Abstract. Three species of zerconid mites were collected from eight localities in Crete, Greece. One of them (*Prozercon yavuzi* Urhan, 1998) is already known, the remaining two species, *Prozercon rekaae* sp. n. and *Zercon cretensis* sp. n. proved to be new to science. With 20 figures.

INTRODUCTION

Crete is situated in the eastern part of the Mediterranean. As one of the biggest islands of the region, it forms a border between the Cretan Sea and the Lybian Sea. Until the lower Miocene the Balkan Peninsula was connected to Asia Minor by the ancient Aegis. At the end of Miocene the Aegean plate submerged, so the continuous continental bridge was broken and several islands were separated from Asia Minor and the Greek mainland, including the Cretan Archipelago. From the beginning of Pleistocene extensive uplift of the area has joined many of the small islands forming the present Crete (Simaikakis *et al.*, 2004).

Members of the family Zerconidae are widely prevalent in the Holarctic region and represented by 35 genera and more than 300 species. They are free-living predators, occurring mostly in moss and leaf litter, constituting an important part of the soil fauna.

Our knowledge on the zerconid fauna of Southeast Europe is quite unbalanced. Only a few papers were published on zerconid mites of the Balkan Peninsula (Willmann, 1941; Balogh, 1961; Košir, 1974; Koyumdjieva, 1986, 1993; Błaszkak & Polańska, 1998; Kentschán, 2006; Ujvári, 2008). On the contrary, the fauna of Asia

Minor (Turkey) is well known (Urhan 1999, 2007b, 2008a; Urhan & Ayyıldız 1992, 1994b, 1996a, 1996b, 1996c; Urhan & Ekiz, 2002; Urhan *et al.*, 2007), and several new species have been described from the region (Urhan, 1997, 1998a, 1998b, 1999, 2001a, 2001b, 2001c, 2001d, 2002, 2007a, 2007b, 2008a, 2008b; Urhan & Ayyıldız, 1992, 1994a, 1994b, 1996a, 1996b, 1996c, 1996d, 1996e, 1996f, 1996g).

No zerconid mites have been mentioned from Greece, neither from the islands of the Aegean Sea (including Crete) so far. However, it is important to note that the group is represented in North Africa (Athias-Henriot, 1961; Błaszkak, 1979), and many of those species are considerably similar to the mites found on Crete.

MATERIALS AND METHODS

Specimens were separated under a stereo-microscope, cleared in lactic acid and impregnated with glycerin. Preparations were examined using light microscope, drawings were made with camera lucida. Mites are stored in 75% ethanol and deposited in the Soil Zoology Collections of the Hungarian Natural History Museum, Budapest. In the descriptions of new species, terminology of setae follows Sellnick (1958) and Błaszkak (1974). Measurements are given in micrometers (μm), presented as mean.

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DESCRIPTIONS OF THE SPECIES

Prozercon yavuzi Urhan, 1998

(Fig. 1)

Material examined. E-1592, Crete, 2 km north of Knossos, moss from rocky hillside, 02.03.2003., leg. Szűts, T.

Diagnosis. Female. Length of idiosoma: 348 μm ; width: 271 μm ($n=4$). Podonotal setae pilose, except i_4 . On opisthonotum, all I, Z, S setae plumose. Setae of Z and S row shorter than I-setae. Setae S_3 absent. Marginal R-row with 6 pairs of setae, R_1 longer, plumose, others smooth, thickened, pointed. Dorsal fossae weakly developed.

Remarks. This species was originally described from Turkey, and the present record is the first for Greece.

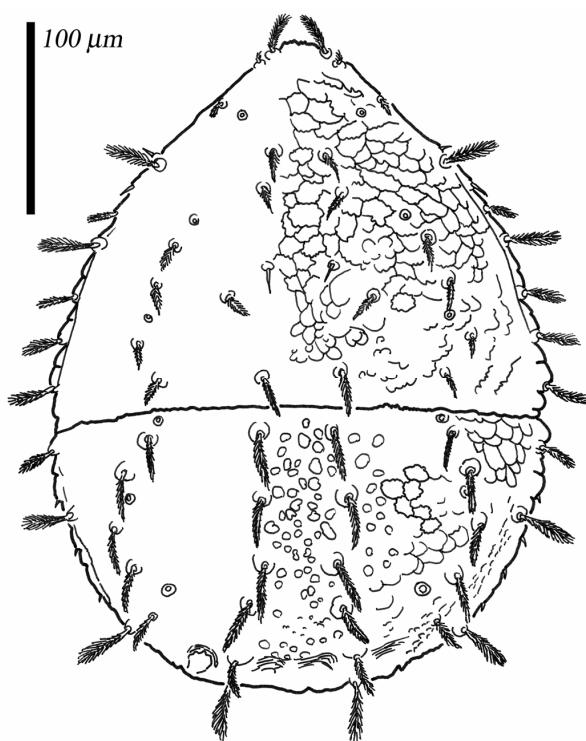


Figure 1. *Prozercon yavuzi* Urhan, 1998. Female, dorsal view of the idiosoma

Prozercon rekaae sp. n.

(Figs. 2–13)

Material examined. Holotype: female, E-1597, Crete, 5 km north of Knossos, *Platanus occidentalis* forest over Agia Irini stream, from leaf litter, 03.03.2003., leg. Szűts, T. Paratypes: 9 females and 2 males, same data as holotype. Other localities: 1 female: E-1595, Crete, 5 km north of Knossos, *Platanus occidentalis* forest over Agia Irini stream, from leaf litter, 03.03.2003., leg. Szűts, T.; 1 female: E-1592, Crete, 2 km north of Knossos, moss from rocky hillside, 02.03.2003., leg. Szűts, T.

Diagnosis: Podonotal setae of s- and z-setal rows smooth and needle-like. Opistonothal I-setae medium sized, I_1 smooth, I_2 – I_5 slightly pilose, situated on large, bulb-like tubercles, not any of them reaching the following's bases. Z-setal row situated on large tubercles, Z_4 long, densely plumose. S_1 smooth, equal in length and appearance to setae Z_1 and situated lateral to them. S_2 – S_4 approximately of equal size and appearance, brush-like and plumose. Dorsal fossae well sclerotized.

Description. Female. Length of idiosoma 335 μm , width 265 μm ($n=8$).

Dorsal side (Fig. 10). On podonotum, 22 pairs of different setae. The i-setal row with 6 pairs, z-row with 2 pairs, s-row with 5 pairs, p-row with 2 pairs, r-row with 7 pairs (p_2 visible on ventral view, not represented on dorsal fig.). Setae r_1 , r_3 – r_7 elongated, plumose, i_1 , r_2 and r_3 short, pilose. All other setae short, smooth, needle-like. Pores po_1 posterior to insertions of setae s_1 , po_2 antero-medially to insertions of s_3 (on the line connecting s_3 and i_4 , nearer insertion of s_3), po_3 situated medially to the line connecting s_4 and s_5 , equidistant from insertions of the two setae. Anterior 80% covered with irregular tile-like pattern, remaining posterior part covered with irregular spots. On opisthonotum, 23 pairs of different setae (Figs. 2–9), I-setal row with 6 pairs, Z-row with 5 pairs, S-row with 4 pairs, R-row with 8 pairs. Setae I_1 short, smooth, I_2 – I_5 medium-sized, slightly pilose, not reaching the following's bases. Setae I_6 long,

plumose and brush-like. Setae Z_1 smooth, medium-sized, similar to S_1 . Setae Z_2 and Z_3 smooth, medium-sized, but longer than Z_1 . Setae Z_1 not reaching the following's bases, so as Z_2 . Setae Z_3 may reach the bases of Z_4 . Setae Z_4 long, strongly plumose on distal half and brush-like, reaching the margin of opisthonotum. Z_5 pilose, may slightly plumose. Setae S_2 - S_4 long, plumose, similar to I_6 . Setae R_1 - R_8 smooth, stout and pointed. Setae I_1 - I_5 , Z_1 - Z_4 and S_1 situated on different-sized but quite large, bulb-like tubercles. Pores Po_1 near the insertions of Z_1 antero-medially to them. Pores Po_2 situated on the line connecting insertions of S_1 and Z_2 (or laterally, but equidis-

tant from these two bases). Pores Po_3 close to insertions of Z_4 , lateral to them. Po_4 close to insertions of S_4 . Opisthonotum punctate, with irregular, small, spot-like cavities and pits as sculpturing. Dorsal fossae large, well-sclerotized.

Measurements of setae and longitudinal distances between their bases as in Table 1.

Ventral side (Fig. 11). shape and chaetotaxy of peritremal shield typical for genus *Prozercon*. Lateral ends of peritremal shield reach R_4 . Anterior margin of ventroanal shield with one pair of setae.

Table 1. Length of opisthonotal setae and longitudinal distances between their bases in *Prozercon rekaae* sp. n. female (values in μm)

I1	14-16 (15)	Z1	13-15 (14)	S1	12-14 (13)
I1-I2	33-36 (35)	Z1-Z2	33-36 (35)	S1-S2	35-37 (36)
I2	16-17 (17)	Z2	13-16 (15)	S2	30-33 (32)
I2-I3	28-33 (31)	Z2-Z3	30-32 (31)	S2-S3	37-42 (40)
I3	15-17 (16)	Z3	17-19 (18)	S3	28-32 (30)
I3-I4	27-26 (25)	Z3-Z4	22-24 (24)	S3-S4	38-43 (41)
I4	12-14 (13)	Z4	32-39 (36)	S4	28-35 (32)
I4-I5	19-24 (21)	Z4-Z5	39-44 (41)		
I5	9-12 (11)	Z5	26-27 (27)		
I5-I6	21-27 (23)				
I6	33-37 (35)				

Table 2. Length of opisthonotal setae and longitudinal distances between their bases in *Prozercon rekaae* sp. n. male (values in μm)

I1	10	Z1	11	S1	10
I1-I2	30	Z1-Z2	26	S1-S2	30
I2	12	Z2	12	S2	25
I2-I3	24	Z2-Z3	24	S2-S3	31
I3	13	Z3	15	S3	29
I3-I4	21	Z3-Z4	22	S3-S4	36
I4	12	Z4	17	S4	32
I4-I5	16	Z4-Z5	30		
I5	7	Z5	20		
I5-I6	19				
I6	31				

Table 3. Differences between *Prozercon rekuae* sp. n. and *Prozercon verruciger* Mašán & Fend'a, 2004

	<i>Prozercon rekuae</i> sp. n.	<i>Prozercon verruciger</i>
Setae I₁	Smooth, short	Pilose, medium-sized
Length of setae I₁-I₄	10-13 µm	18-25 µm
Setae Z₄	long, densely plumose, brush-like	medium-sized, pilose
Length and shape of setae I₆, S₂₋₄	30-37 µm ending of setae plumose	24-30 µm densely plumose, brush-like
Situation of Z₁ and S₁	S ₁ situated (postero-) laterally to Z ₁	S ₁ situated antero-laterally to Z ₁
Situation of Po₂	lateral position to Z ₂	anterior position to Z ₂
Dorsal fossae	well-sclerotized	weakly indicated or absent
Lateral ends of peritremal shield	reaching R ₄	reaching R ₆
Size and shape of tubercles	quite divers in I-setal row	quite uniform in I-setal row
Setae I₅	not reaching posterior margin of the opisthonotum	reaching posterior margin of the opisthonotum

Male. Length of idiosoma 280 µm, width 220 µm (n=1).

Dorsum & venter (Figs. 12-13). Setae, pores and ornamentation of podonotum and opisthonotum as in female, except Z₄, which similar to Z₂ and Z₃, medium-sized and slightly pilose in male (r₂ short and smooth in male).

The size of setae and the longitudinal distance between their bases as in Table 2.

Etymology. The species is dedicated to my betrothed, Réka Farkas

Remarks. This species closely resembles *Prozercon verruciger* Mašán & Fend'a, 2004, recorded only from Slovakia and Hungary so far, but can be distinguished by many characters, summarized in Table 3.

Zercon cretensis sp. n.

(Figs. 14-20)

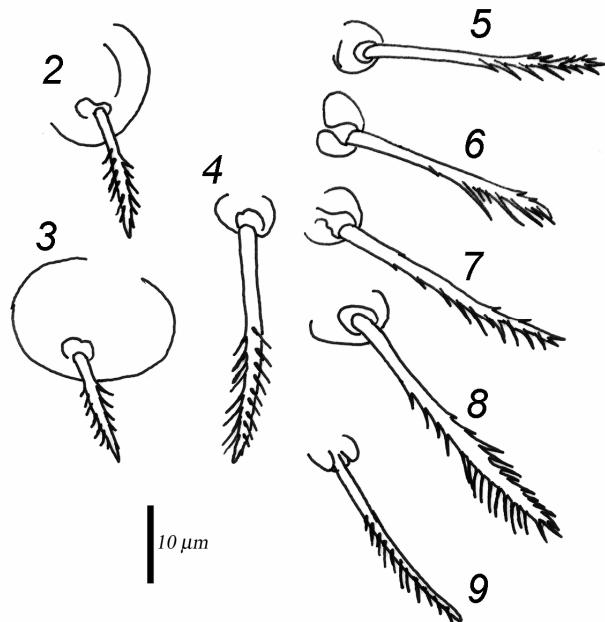
Material examined. Holotype: female, E-1596, Crete, 5 km north of Knossos, *Platanus occidentalis* forest over Agia Irini stream, from leaf litter, 03.03.2003., leg. Szűts, T. Paratypes: 3 females, E-1595, Crete, 5 km north of Knossos, *Platanus occidentalis* forest over Agia Irini stream, from leaf litter, 03.03.2003., leg. Szűts, T. Other localities: 4 females, 1 nymph: E-1592, Crete, 2 km north of Knossos, moss from rocky

hillside, 02.03.2003., leg. Szűts, T.; 8 females: E-1593, Crete, 2 km north of Knossos, lichen, mushroom and hifa from rocky hillside, 02.03.2003., leg. Szűts, T.; 2 females, 2 nympha: E-1594, Crete, 2 km north of Knossos, moss from rocky hillside, 02.03.2003., leg. Szűts, T.; 4 females: E-1597, Crete, 5 km north of Knossos, *Platanus occidentalis* forest over Agia Irini stream, from leaf litter, 03.03.2003., leg. Szűts, T.; 1 female: E-1598, Crete, 5 km north of Knossos, *Platanus occidentalis* forest over Agia Irini stream, from wash, 03.03.2003., leg. Szűts, T.; 13 females: E-1600, 2 kms from Agios Thomas, near road, from rock-moss.

Diagnosis. podonotal setae smooth, except r₅₋₇, which slightly pilose. On opisthonotum, I₃₋₆, Z₃₋₄, S₂₋₄ elongated, barely pilose, others smooth. Marginal R-row with stout, medium-sized setae, R₁₋₃ barely pilose, R₄₋₇ smooth. Setae I₅ shorter than I₃, I₄ and I₆. Dorsal cavities of general size and appearance. Podonotum and anterior half of opisthonotum reticulate, posterior half of latter punctate.

Description. Female. Length of idiosoma 455 µm, width 348 µm (n = 10).

Dorsum (Fig. 14). On podonotum, 22 pairs of different setae. The i-setal row with 6 pairs, z-row with 2 pairs, s-row with 5 pairs, p-row with 2 pairs, r-row with 7 pairs (p₂ visible on ventral



Figures 2–9. Opisthonotal setae of *Prozercon rekuae* sp. n. female. 2 = seta Z3, 3 = seta I4, 4 = seta I6, 5 = seta S2, 6 = seta S3, 7 = seta S4, 8 = seta Z4, 9 = seta Z5

view, not represented on dorsal fig.). Setae i_1, r_{5-7} barely pilose, all other podonotal setae smooth, needle-like. Pores po_1 medially to insertions of setae s_1, po_2 situated under the line connecting s_3 and i_4 , equidistant from these setae, po_3 situated under the line connecting s_4 and z_1 , equidistant from insertions of these setae. Podonotum covered with irregular tile-like pattern. Opisthonotum with 22 pairs of different setae (Figs. 17–20), I-setal row with 6 pairs, Z-row with 5 pairs, S-row with 4 pairs, R-row with 7 pairs. Setae I_{1-2} short, smooth, I_3-I_6 long, barely pilose. Setae I_3, I_4 and I_5 almost equal in length, I_5 shorter than others. Setae I_6 longest opisthonotal setae. Setae Z_{1-2} smooth, longer than I_{1-2} . Setae Z_3 similar to I_{3-4} . Setae Z_4 similar to I_6 . Setae Z_5 elongated, smooth, as long as setae I_5 , but more slender. Setae S_1 equal in length and shape to Z_{1-2} . Setae S_2-S_3 long, barely pilose, similar to I_{3-4} . Setae S_4 similar to I_6 . Setae R_1-R_7 elongated, stout, barely pilose, with rounded endings. About the pilose setae: $R_{5-7}, I_{3-5}, Z_{3-4}, S_{2-4}, R_{1-3}$ with very fine pilosity on the middle or on distal part, but not apically. Pores Po_1 near the insertions of Z_1 antero-medially to them. Po_2 situated on the line connecting inser-

tions of setae S_2 and Z_2 (or slightly above it). Pores Po_3 near insertions of Z_4 , just above the line connecting bases of Z_4 and I_5 . Opisthonotum with irregular tile-like pattern (anterior 30–40%) and punctuation (posteriorly). Dorsal fossae of general size and appearance, saddle-like, with smooth anterior margin.

Measurements of setae and longitudinal distances between their bases as in Table 4.

Venter (Fig. 15). shape and chaetotaxy of ventroanal shield is typical for the genus *Zercon*. Anterior margin of ventroanal shield with one pair of setae.

Deutonymph (Fig. 16). Length of idiosoma 385 μ m, width 281 μ m ($n = 1$).

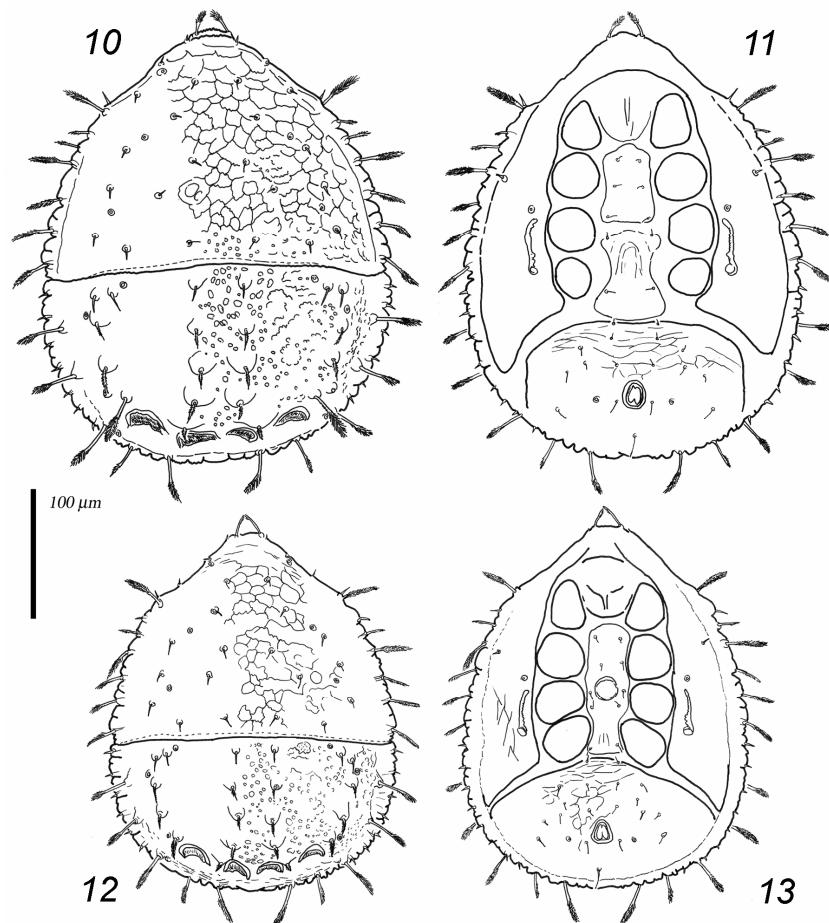
Podonotal setae smooth. On opisthonotum, setae I_{1-5}, Z_{1-2} and R setae short, smooth. I_6, Z_{3-4}, S_{1-4} elongated, more pilose, than in adult stage. Situation of podonotal and opisthonotal pores similar to adults. Chaetotaxy of venter as in adults. Dorsal idiosoma mostly without reticulation. Measurements of setae and longitudinal distances between their bases as in Table 5.

Etymology: This species is named after the Island of Crete, where it has been found.

Remarks. The species is most similar in appearance to the following species: *Zercon agnustus* Błaszk, 1979, *Z. ayyildizi* Urhan, 1997, *Z. turcicus* Urhan & Ayyildiz, 1994 (from Turkey), *Z. salebrosus* Błaszk, 1979 and *Z. saphenus* Błaszk, 1979 (from Tunisia). Differences between these species are given in Table 6.

DISCUSSION

The island is situated 100 kms from the Balkan Peninsula, 200 kms from Asia Minor and 300 kms from the northern coast of Africa. Because of the continental connections in the Miocene, the fauna of Crete is composed by three main elements: European, Mediterranean and Asiatic. Several papers discuss the different zoogeographical ef-



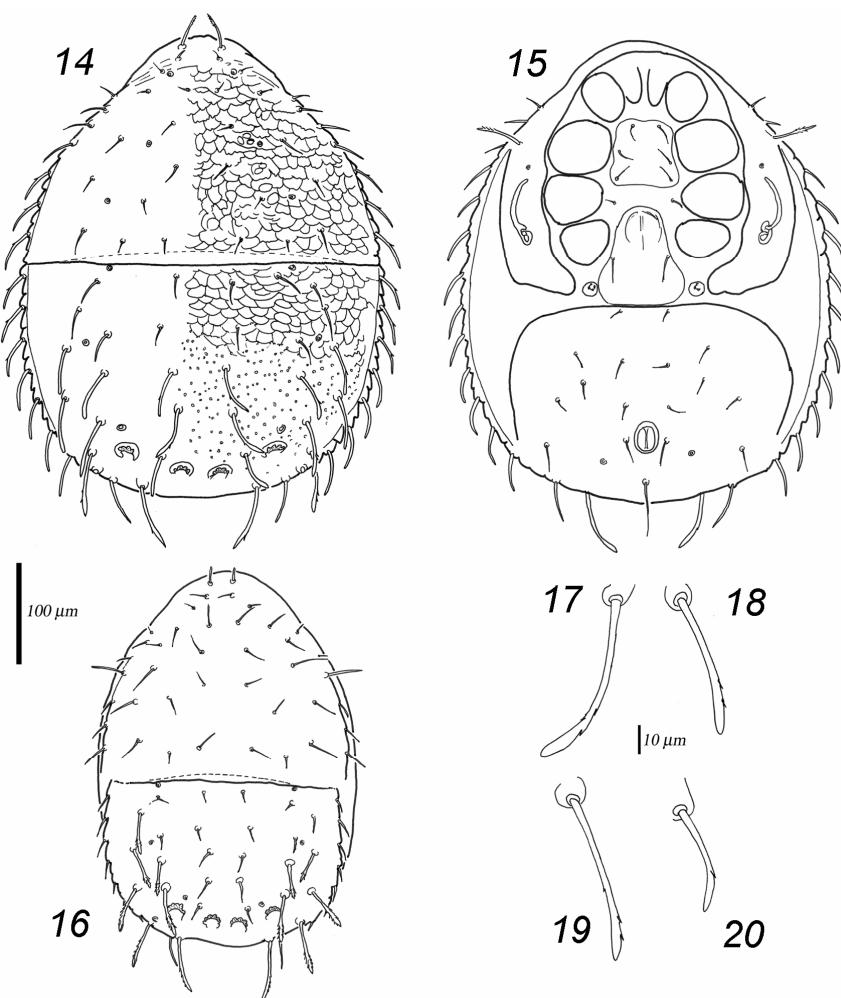
Figures 10–13. *Prozercon rekaae* sp. n.: 10 = female, dorsal idiosoma, 11 = female, ventral idiosoma, 12 = male, dorsal idiosoma, 13 = male, ventral idiosoma

Table 4. Length of opisthonotal setae and longitudinal distances between their bases in *Zercon cretensis* sp. n. female (values in µm)

I1	17-19 (18)	Z1	24-26 (25)	S1	26-30 (29)
I1-I2	45-54 (50)	Z1-Z2	50-60 (55)	S1-S2	36-45 (41)
I2	24-30 (26)	Z2	32-36 (34)	S2	49-52 (51)
I2-I3	42-51 (47)	Z2-Z3	33-40 (35)	S2-S3	43-52 (48)
I3	50-53 (52)	Z3	48-50 (49)	S3	52-57 (54)
I3-I4	39-45 (42)	Z3-Z4	39-46 (43)	S3-S4	59-62 (60)
I4	52-56 (54)	Z4	56-59 (58)	S4	62-63 (62)
I4-I5	34-43 (38)	Z4-Z5	59-61 (60)		
I5	48-51 (50)	Z5	43-46 (44)		
I5-I6	34-37 (35)				
I6	64-68 (66)				

Table 5. Length of opisthonotal setae and longitudinal distances between their bases in *Zercon cretensis* sp. n. deutonymph (values in μm)

I1	11	Z1	11	S1	30
I1-I2	36	Z1-Z2	36	S1-S2	37
I2	13	Z2	15	S2	37
I2-I3	27	Z2-Z3	26	S2-S3	38
I3	18	Z3	35	S3	45
I3-I4	27	Z3-Z4	29	S3-S4	35
I4	21	Z4	47	S4	49
I4-I5	27	Z4-Z5	44		30
I5	16	Z5	31		37
I5-I6	37		11		37
I6	58		36		38



Figures 14–20. *Zercon cretensis* sp. n. 14 = female, dorsal idiosoma, 15 = female, ventral idiosoma, 16 = deutonymph, dorsal idiosoma, 17 = seta I6, 18 = seta Z3, 19 = seta S4, 20 = seta R4

fects on the soil fauna (Ćurčić *et al.*, 2007; Simaiakis *et al.*, 2004), in general European, different Mediterranean and Balkanic elements have a greater presence.

Our knowledge on the distribution of zerconid mites, especially in Southern Europe and the Asian regions is considerably scarce. Hence any zoogeographical remarks must be made very cautiously. *Prozercon yavuzi*, as a species up to now known only from Turkey seems to be an East Mediterranean element. *Zercon cretensis* sp. n. morphologically most closely related to the East-

Mediterranean and African species, also can be an East Mediterranean element, but because of the short distance between Crete and Africa, the opportunity of colonization from there should not be excluded. Regarding to the morphological aspect, *Prozercon rekaae* sp. n. is fairly unique in the group (because of the large opisthonotal tubercles resembles only a Slovakian species, *Prozercon verruciger* which has a North Carpathian distribution). For more solid information of zoogeographical history of zerconid species further examination of the region's fauna is required.

Table 6. Differences between *Zercon cretensis* sp. n., *Zercon agnustus* Błaszk, 1979, *Zercon ayyildizi* Urhan, 1997, *Zercon turcicus* Urhan & Ayyıldız, 1994, *Zercon salebrosus* Błaszk, 1979 and *Zercon saphenus* Błaszk, 1979

<i>Zercon cretensis</i>	<i>Zercon agnustus</i>	<i>Zercon ayyildizi</i>
setae I ₂ short, smooth	setae I ₂ long, barbed	setae I ₂ long, broadened with hyaline ending
setae I ₅ shorter than I _{3,4} , reaching the margins of idiosoma	setae I ₅ shorter than I _{3,4} , never reaching the margins of idiosoma	setae I ₅ longer than I _{3,4} , reaching the margins of idiosoma
setae Z ₂ short, smooth	setae Z ₂ short, pilose	setae Z ₂ long, with hyaline tips
setae S ₁ short, smooth	setae S ₁ short, pilose	setae S ₁ long, with hyaline tips
R _{1,3} barely pilose, other R-setae smooth	all R-setae barbed	all R-setae barbed, with hyaline tips
Po ₂ on or above the line connecting bases of S ₂ and Z ₂	Po ₂ under the line connecting bases of S ₂ and Z ₂	Po ₂ on the line connecting bases of S ₂ and Z ₂
elongated setae with rounded endings	elongated setae with pointed endings	elongated setae with hyaline endings
elongated setae medially, barely pilose	elongated setae distally pilose	elongated setae distally pilose
dorsal fossae of general size and appearance	dorsal fossae of general size and appearance	dorsal fossae more sclerotized
<i>Zercon salebrosus</i>	<i>Zercon saphenus</i>	<i>Zercon turcicus</i>
setae I ₂ short, with hyaline ending	setae I ₂ short, smooth	setae I ₂ short, smooth
setae I ₅ shorter than I _{3,4} , never reaching the margins of idiosoma	setae I ₅ longer than I _{3,4} , never reaching the margins of idiosoma	setae I ₅ shorter than I _{3,4} , reaching the margins of idiosoma
setae Z ₂ short, with hyaline tips	setae Z ₂ short, smooth	setae Z ₂ short, smooth
setae S ₁ short, with hyaline tips	setae S ₁ short, with hyaline tips	setae S ₁ short, smooth
all R-setae barbed, with hyaline tips	all R-setae barbed, with hyaline tips	all R-setae barbed
Po ₂ under the line connecting bases of S ₂ and Z ₂	Po ₂ under the line connecting bases of S ₂ and Z ₂	Po ₂ on the line connecting bases of S ₂ and Z ₂
elongated setae with hyaline endings	elongated setae with hyaline endings	elongated setae with hyaline endings
elongated setae distally, very finely pilose	elongated setae distally, very finely pilose	elongated setae on distal half pilose
dorsal fossae strongly sclerotized, in a row	dorsal fossae strongly sclerotized	dorsal fossae strongly sclerotized

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